Report for M^{3}D Model & its Implications

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Spatiotemporal Modeling of Human Dynamics Across Social Media and Social Networks
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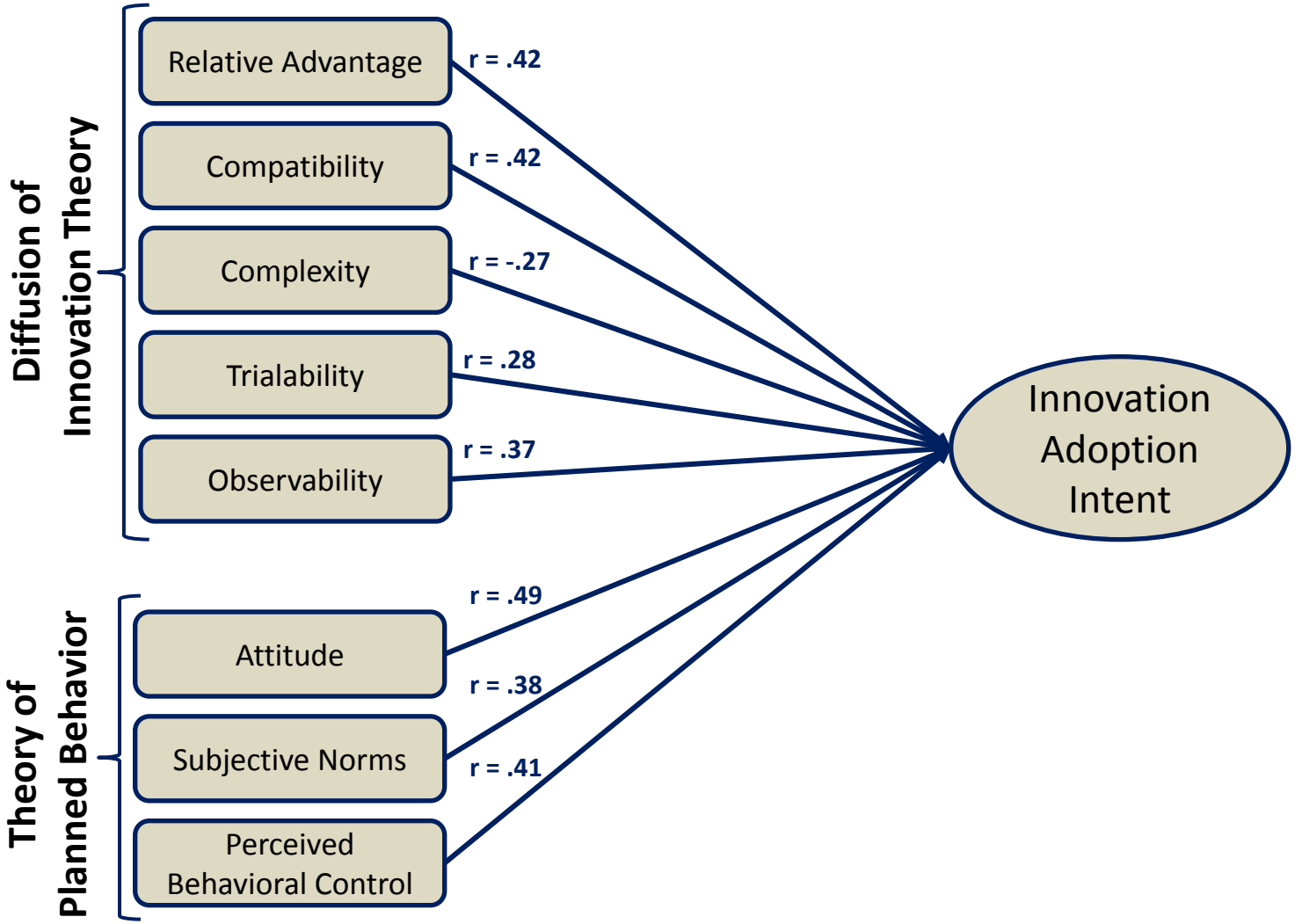
Sir Karl Popper:

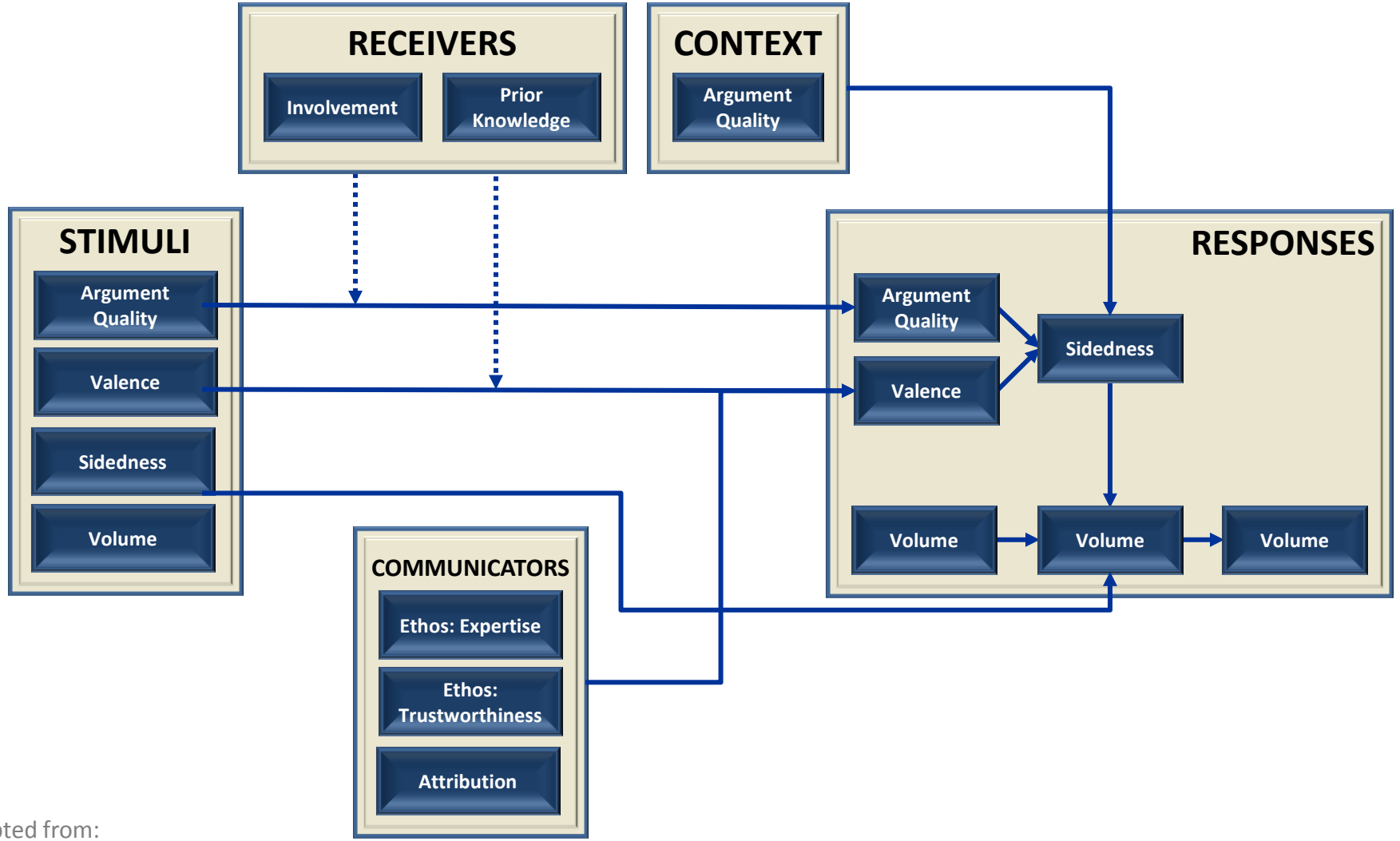
- *"It is easy to obtain confirmations, or verifications, for nearly every theory—if we look for confirmations.*
- *Confirmations should count only if they are the result of risky predictions;...*
- *Every 'good' scientific theory is a prohibition: it forbids certain things to happen. The more a theory forbids, the better it is." (Selections, 1980, p. 167)*

THEORETICAL PREDICTORS OF INNOVATION ADOPTION:



Adapted from:
Weigel, F. K., Hazen, B. T., Cegielski, C. G., & Hall, D. J. (2014). Diffusion of innovations and the theory of planned behavior in information systems research: A metaanalysis. *Communications of the Association for Information Systems, 34*(31), 619-636.

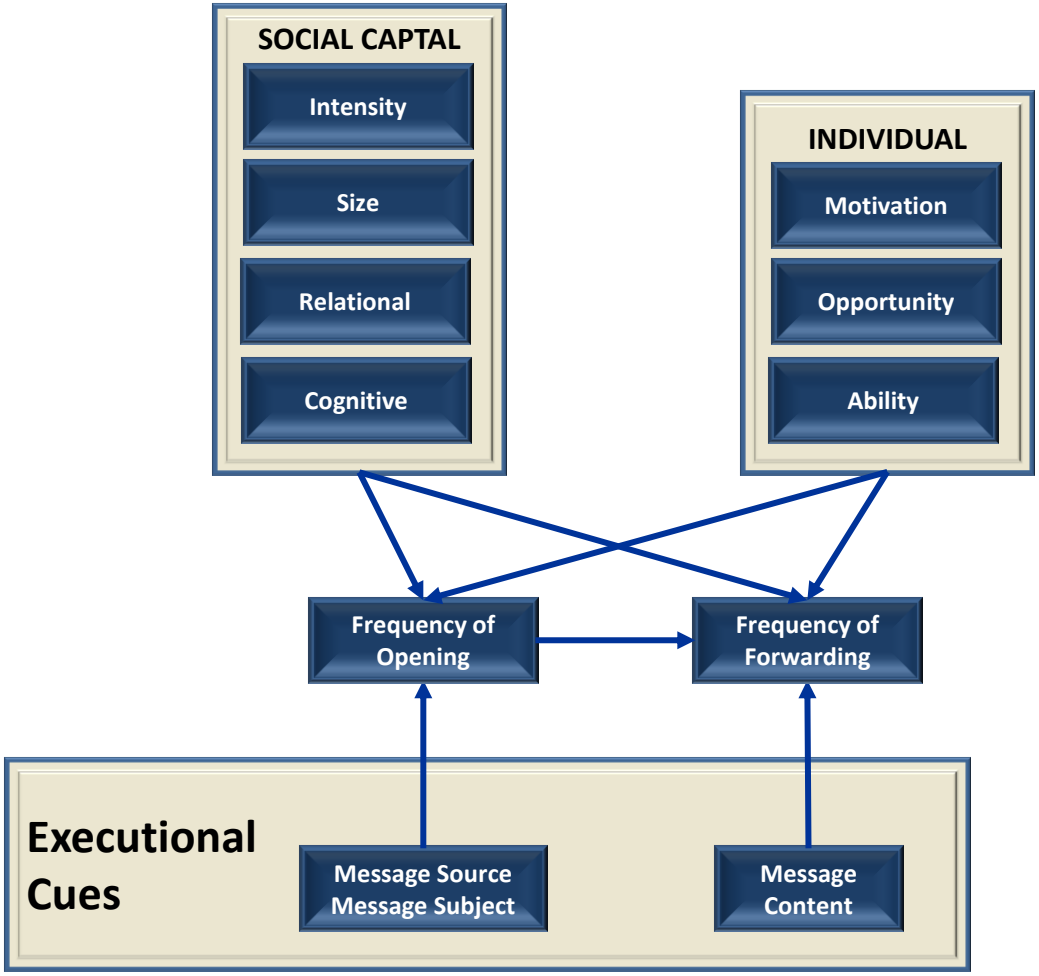
MODEL OF e-Word-of-Mouth (e-WOM) Diffusion:



Adapted from:

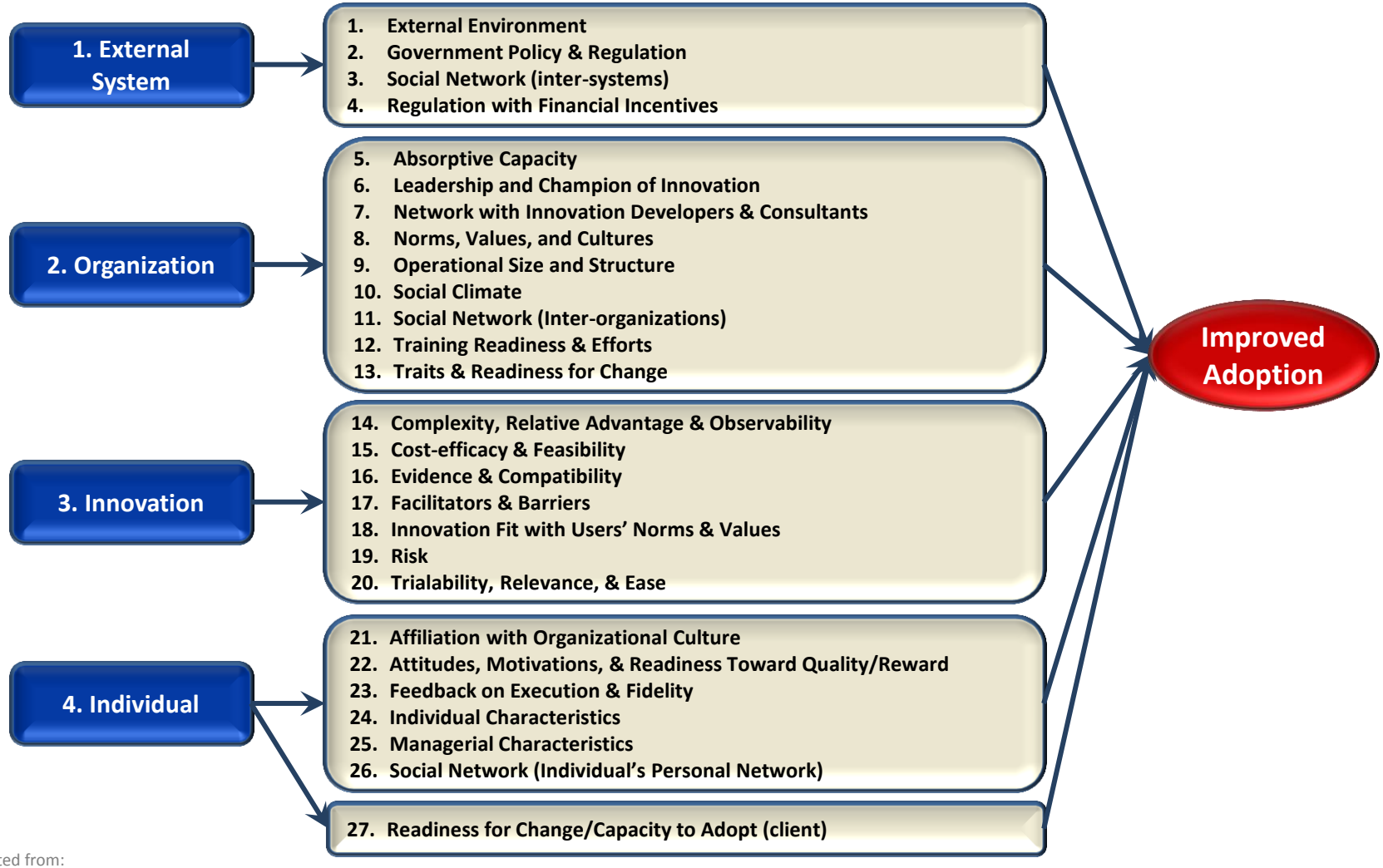
Cheung, C. M. K., & Thadani, D. R. (2012). The impact of electronic word-of-mouth communication: A literature analysis and integrative model. *Decision Support Systems, 54*, 461-470. doi: 10.1016/j.dss.2012.06.008

MODEL OF e-WOM DIFFUSION:



Adapted from:
José-Cabezudo, R. S. & Camarero-Izquierdo, C. (2012). Determinants of opening-forwarding e-mail messages. *Journal of Advertising, 41*, 97-112. doi: 10.2753/JOA0091-3367410207

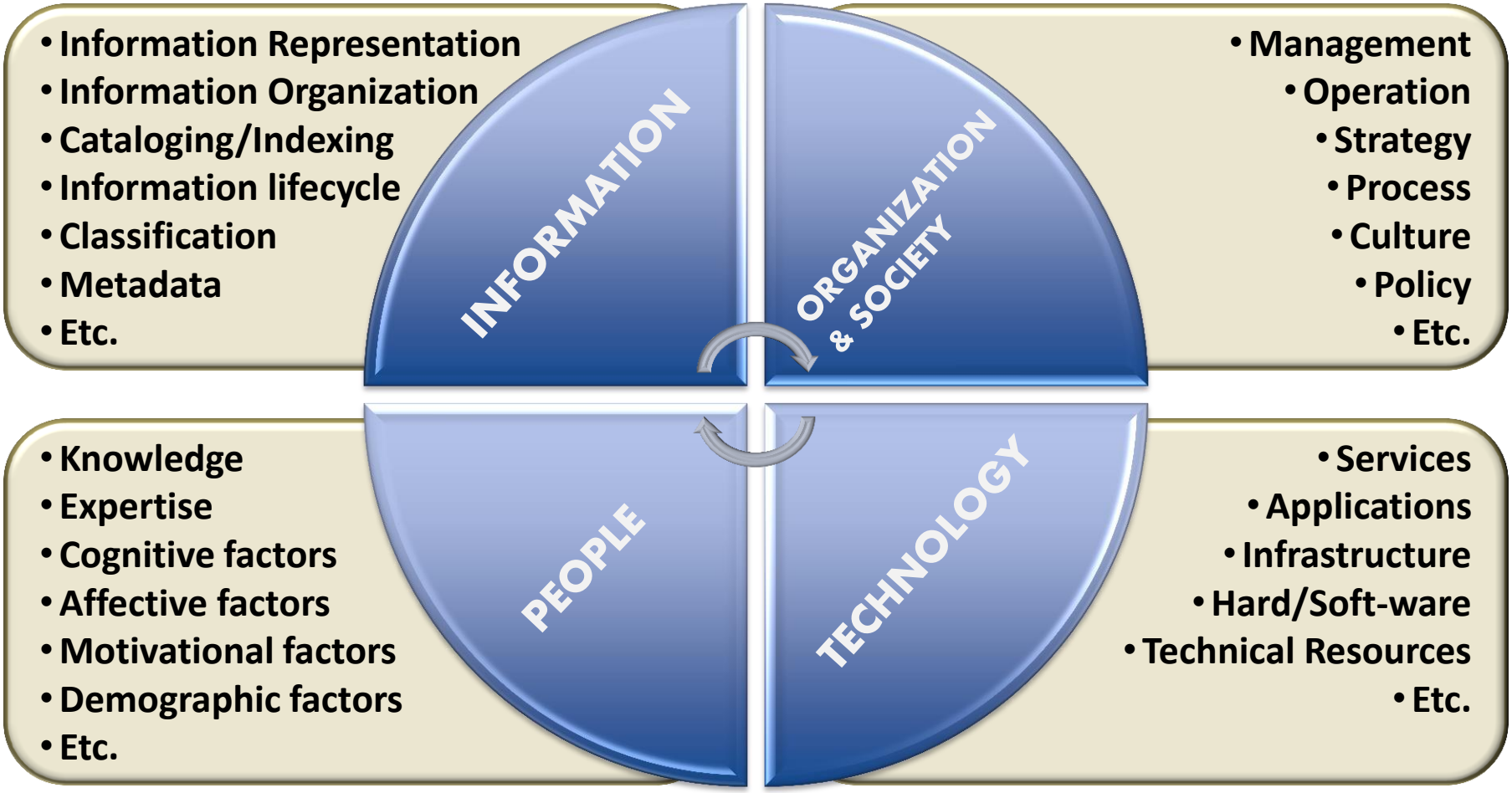
MULTI-LEVEL MODEL OF INNOVATION ADOPTION:



Adapted from:

- Chor, K. B., Wisdom, J. P., Olin, S. S., Hoagwood, K. E., & Horwitz, S. M. (2014). Measures for predictors of innovation adoption. *Administration And Policy In Mental Health And Mental Health Services Research*, doi:10.1007/s10488-014-0551-7
- Wisdom, J. P., Chor, K. B., Hoagwood, K. E., & Horwitz, S. M. (2014). Innovation adoption: A review of theories and constructs. *Administration And Policy In Mental Health And Mental Health Services Research*, *41*(4), 480-502. doi:10.1007/s10488-013-0486-4

MULTI-LEVEL INFORMATION MODEL OF SOCIAL COMMERCE:



Adapted from:
Wang, C., & Zhang, P. (2012). The evolution of social commerce: The people, management, technology, and information dimensions. *Communications of the Association for Information Systems, 31*, 105-127.

MEMES & EVOLUTION—BASIC AXIOMS:

Meme: A *meme* is an act or meaning structure that is capable of *replication*, which means imitation (Dawkins, 1976), requiring:

- Variation
- Selection
- Retention

"memes are remixed and iterated messages which are rapidly spread by members of participatory digital culture" (Wiggins & Bowers, 2014, p. 18)

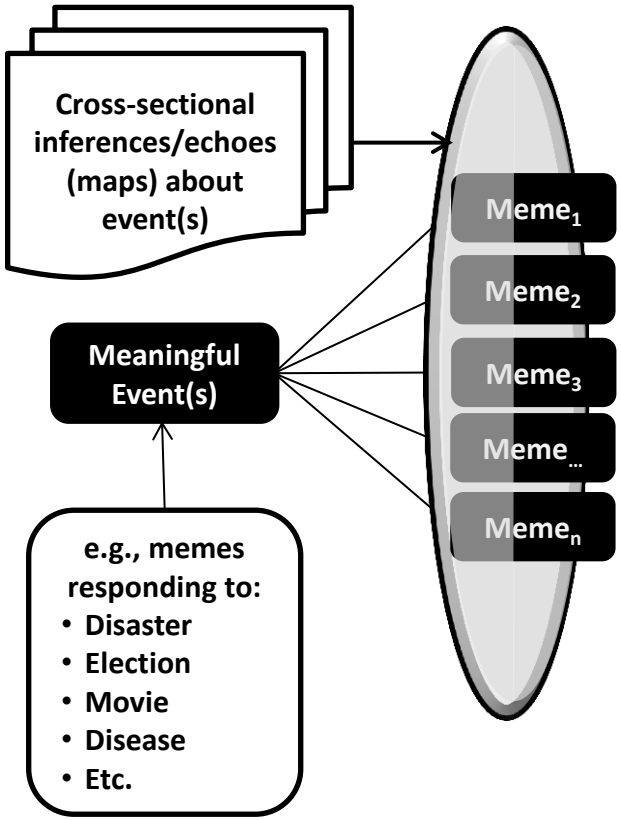
MEMES & EVOLUTION—BASIC AXIOMS:

Asymmetric adaptiveness: "selfishness [i.e., competitiveness] beats altruism within groups. Altruistic groups beat selfish groups. Everything else is commentary" (Wilson & Wilson, 2007).

Scholars are working out the algorithms for modeling meme competition (e.g., Wei et al., 2013; Weng et al., 2012)

TYPES OF MEMETIC DIFFUSION PATTERNS:

Evememic diffusion: event-generated diffusion of memes linked to the event or experience, in which events stimulate similar textual expressions about the experience of an event or set of events (e.g., flu tweets; Nagel et al., 2013).

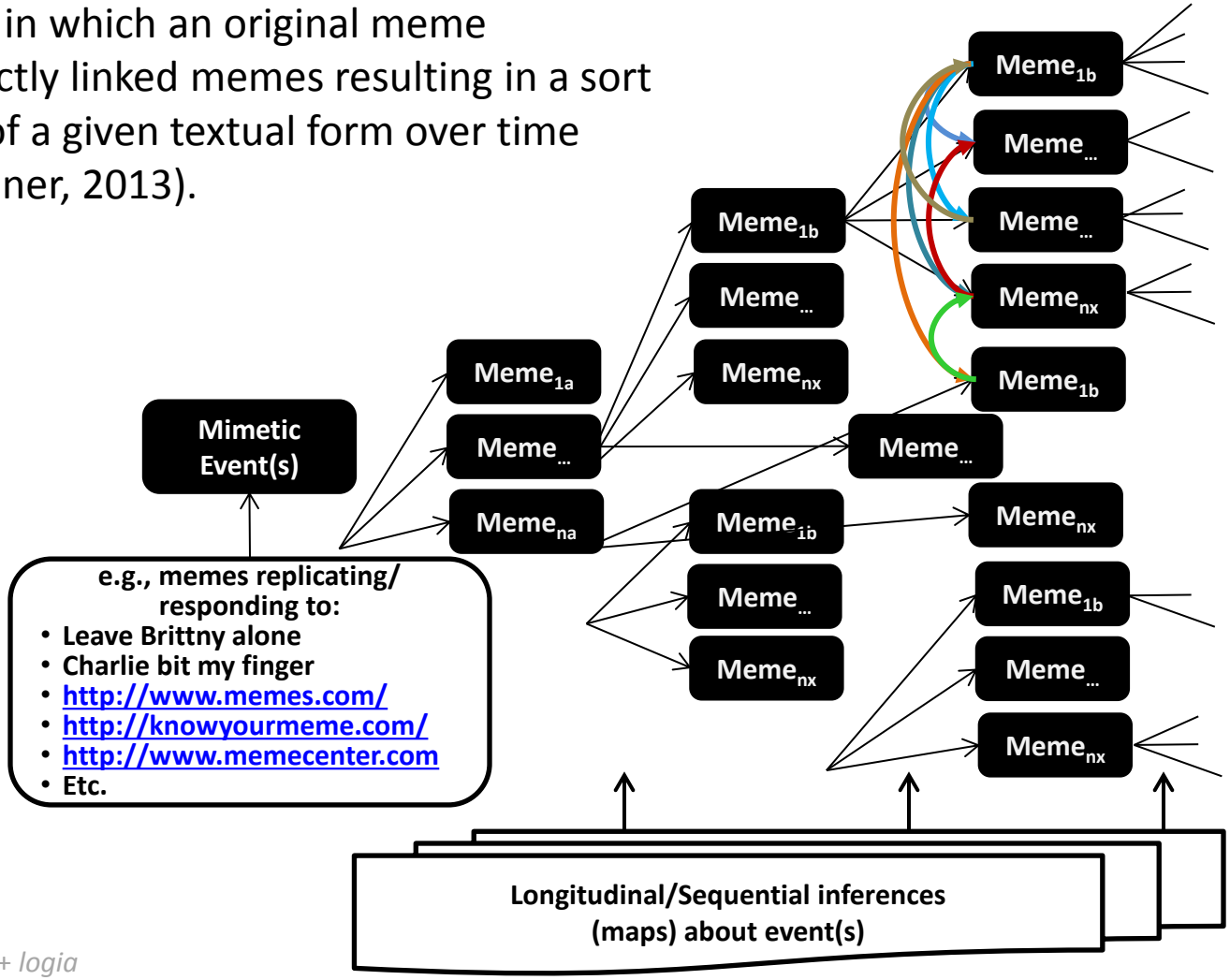


The amount of rain positively predicts social network posts about the rain (Coviello, Fowler, & Franceschetti, 2014)

From: the from *evenire:* Latin *ex-* "out" and *venire* "to come out, happen, result"

TYPES OF MEMETIC DIFFUSION PATTERNS:

Etymemic diffusion: meme-generated diffusion of directly linked memes in which an original meme generates further directly linked memes resulting in a sort of genetic speciation of a given textual form over time (e.g., the riot kiss, Hahner, 2013).



From: the Greek *etymon*—"true sense" + *logia* "study of, a speaking of")

San Diego State University

Kent State University

University of Arkansas

There may be reciprocal effects—Tweeters during presidential debates feel that debates are more important, pay more attention, and feel more valenced toward candidates. Which causes which? (Houston et al., 2013)

Cross-sectional inferences (maps) about event(s)

Meaningful Event(s)

e.g., memes responding to:
- Disease
- Disaster
- Election
- Movie
- Etc.

$Meme_1$
$Meme_2$
$Meme_3$
$Meme_{...}$
$Meme_n$

Mimetic Event(s)

e.g., memes replicating/ responding to:
- Leave Brittny alone
- Charlie bit my finger
- http://www.memes.com/
- http://knowyourmeme.com/
- http://www.memecenter.com
- Etc.

$Meme_{1a}$
$Meme_{...}$
$Meme_{na}$

$Meme_{1b}$
$Meme_{...}$
$Meme_{nx}$
$Meme_{1b}$
$Meme_{...}$
$Meme_{nx}$
$Meme_{1b}$
$Meme_{...}$
$Meme_{nx}$

$Meme_{1b}$
$Meme_{...}$
$Meme_{...}$
$Meme_{nx}$
$Meme_{1b}$
$Meme_{...}$
$Meme_{nx}$

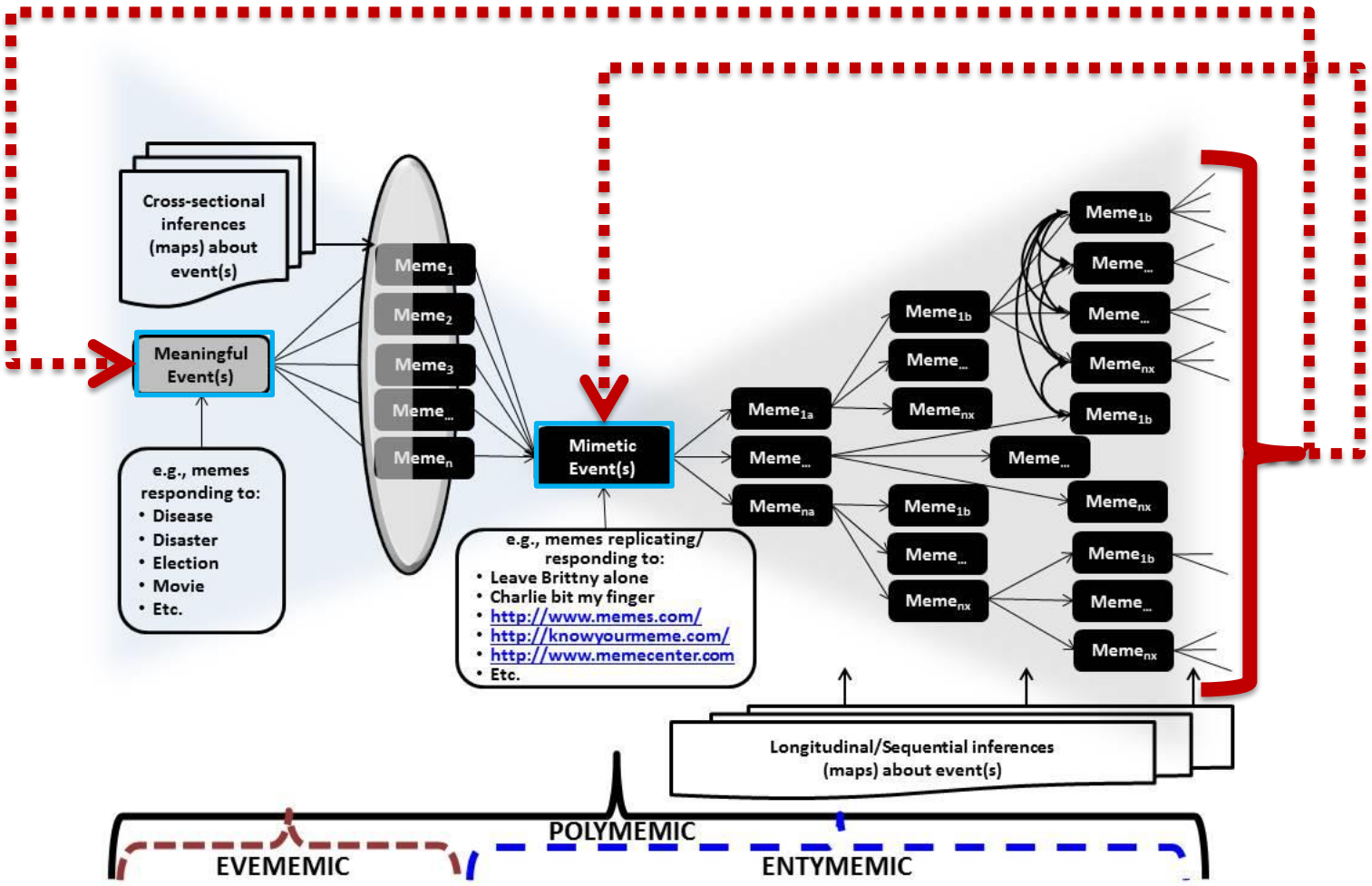
Longitudinal/Sequential inferences (maps) about event(s)

POLYMEMIC

EVEMEMIC

ENTYMEMIC

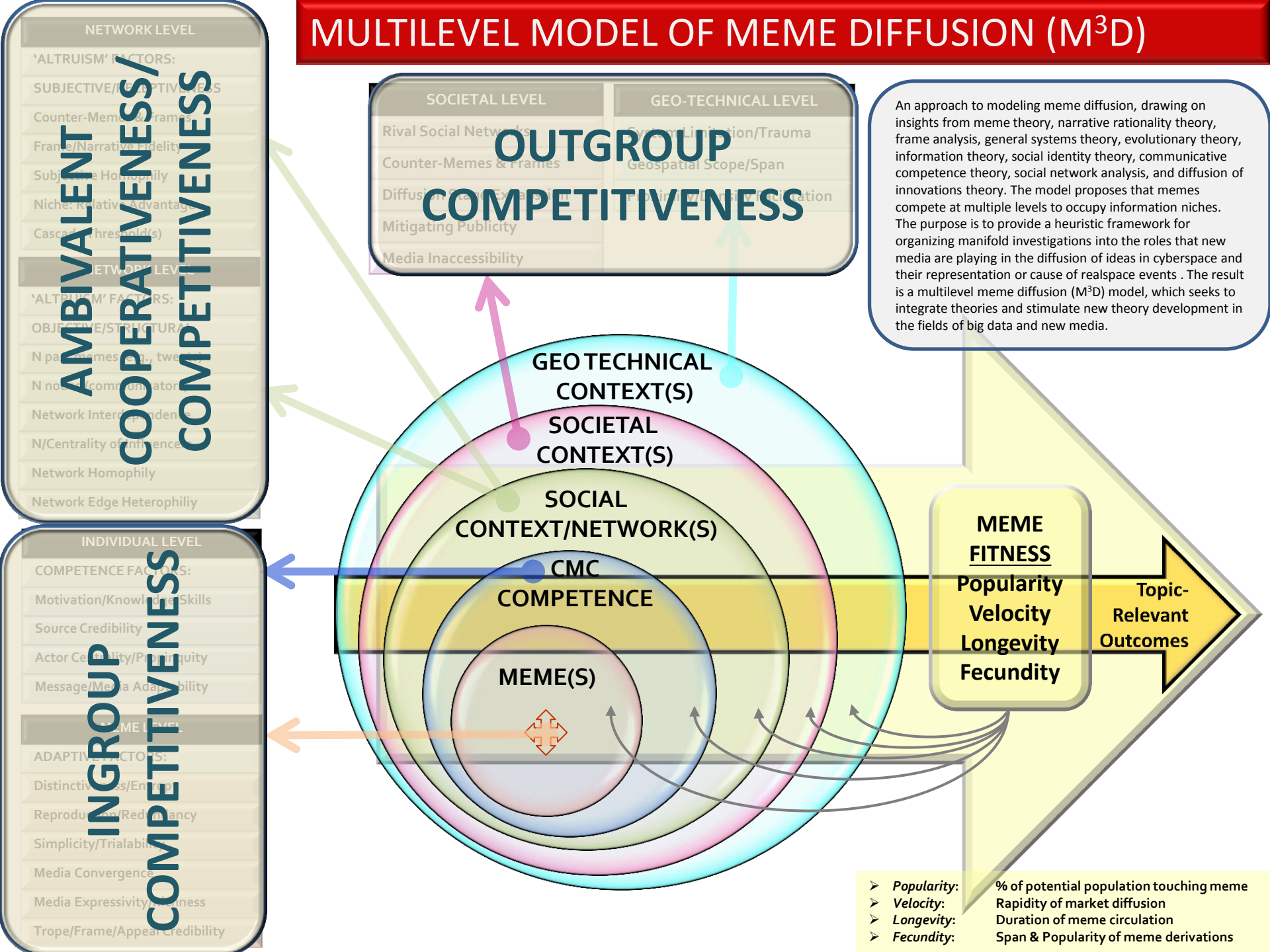
POLYMEMIC FEEDBACK ASPECTS OF MEMETIC DIFFUSION PATTERNS:



APOTHECARY CABINET:

There is structural hierarchy, but some flexibility in regard to which drawer goes where, and more importantly, what goes into each drawer.

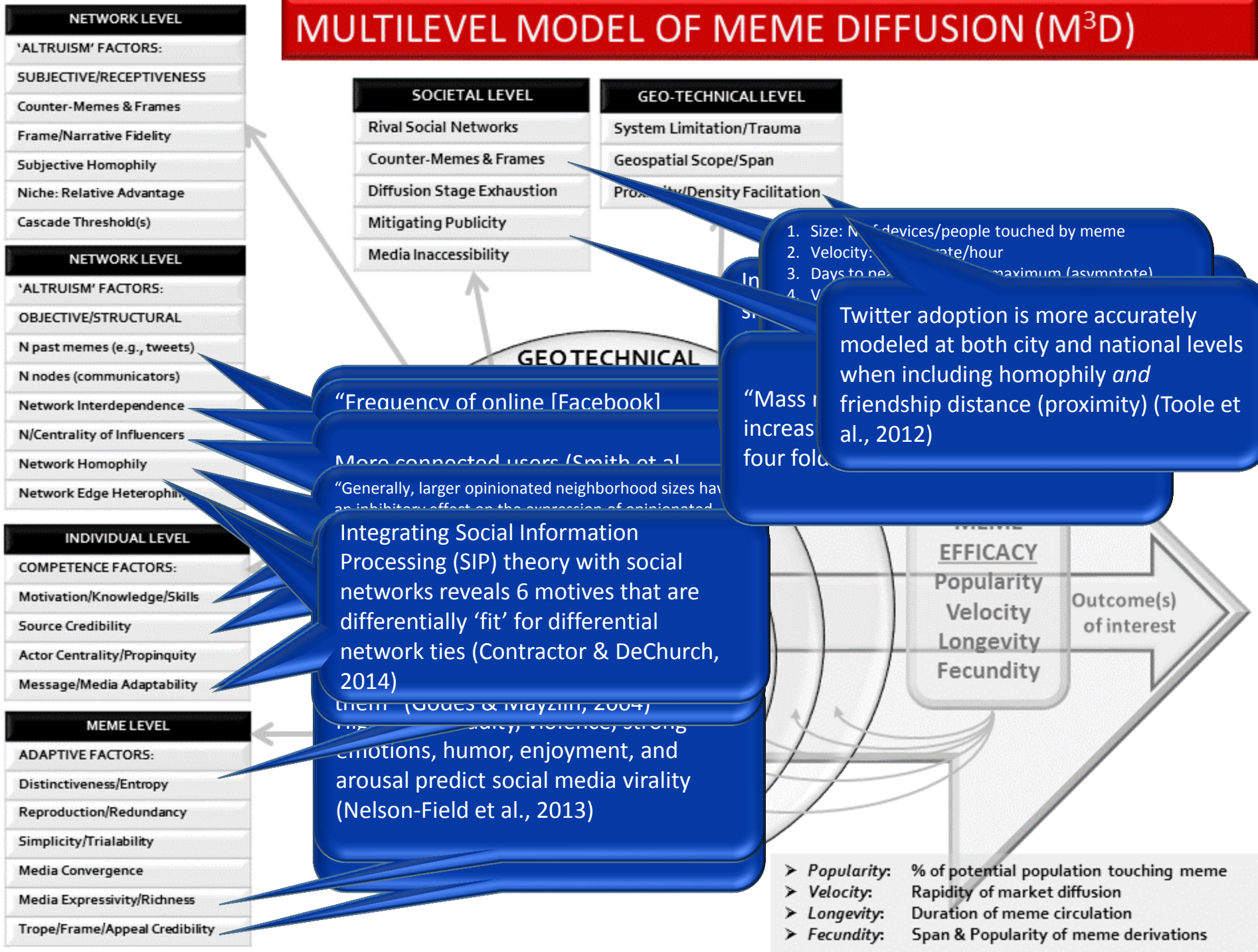
MULTILEVEL MODEL OF MEME DIFFUSION (M^3D)



An approach to modeling meme diffusion, drawing on insights from meme theory, narrative rationality theory, frame analysis, general systems theory, evolutionary theory, information theory, social identity theory, communicative competence theory, social network analysis, and diffusion of innovations theory. The model proposes that memes compete at multiple levels to occupy information niches. The purpose is to provide a heuristic framework for organizing manifold investigations into the roles that new media are playing in the diffusion of ideas in cyberspace and their representation or cause of realspace events . The result is a multilevel meme diffusion (M^3D) model, which seeks to integrate theories and stimulate new theory development in the fields of big data and new media.

- ***Popularity***: % of potential population touching meme
- ***Velocity***: Rapidity of market diffusion
- ***Longevity***: Duration of meme circulation
- ***Fecundity***: Span & Popularity of meme derivations

MULTILEVEL MODEL OF MEME DIFFUSION (M^3D)



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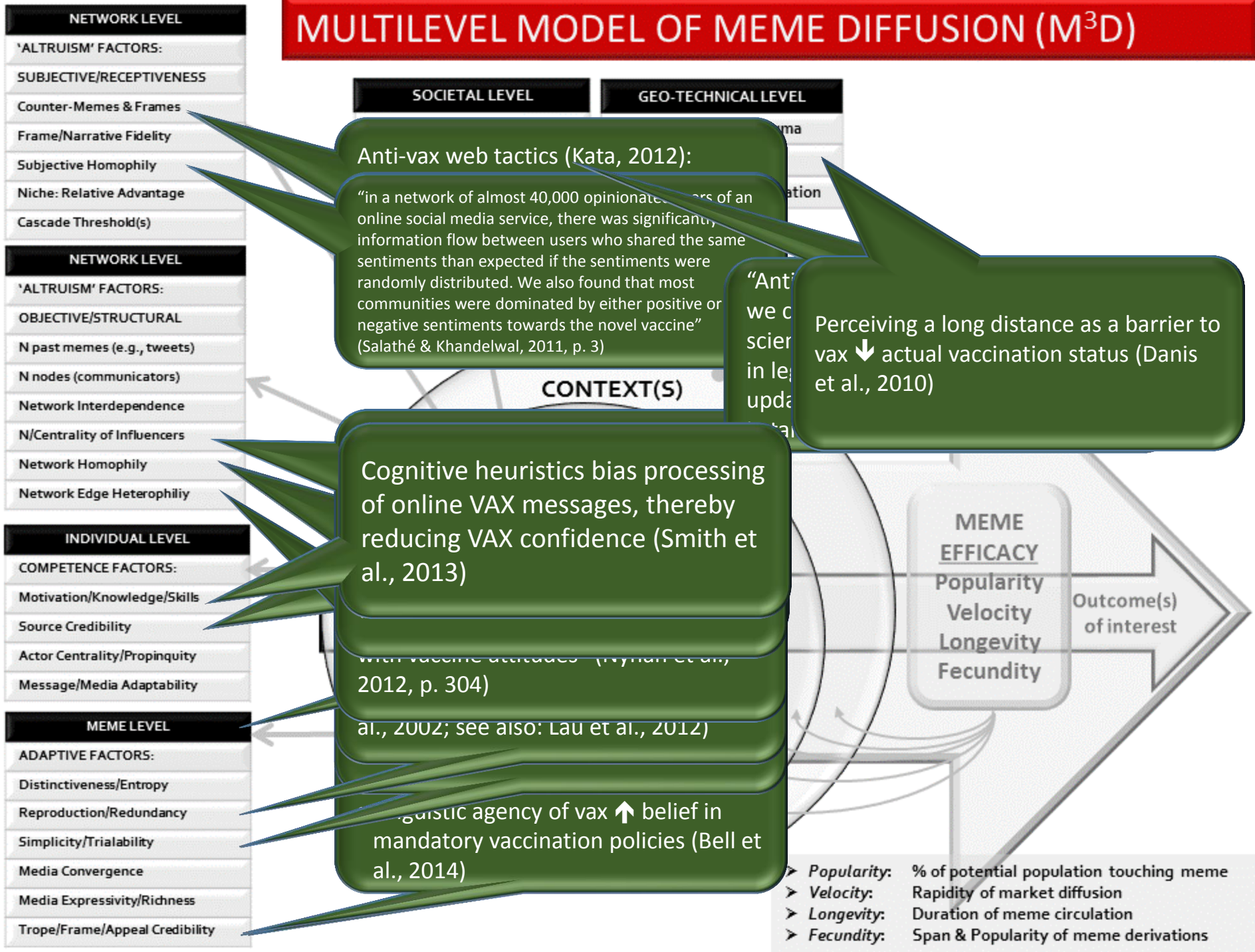

Anti-vax web tactics (Kata, 2012):

"in a network of almost 40,000 opinionate[illegible]ers of an online social media service, there was significant[illegible] information flow between users who shared the same sentiments than expected if the sentiments were randomly distributed. We also found that most communities were dominated by either positive or negative sentiments towards the novel vaccine" (Salathé & Khandelwal, 2011, p. 3)

"Anti[illegible] we c[illegible] scien[illegible] in le[illegible] upda[illegible]

Perceiving a long distance as a barrier to vax ↓ actual vaccination status (Danis et al., 2010)

Cognitive heuristics bias processing of online VAX messages, thereby reducing VAX confidence (Smith et al., 2013)

[illegible] with vaccine attitudes" (Nyhan et al., 2012, p. 304)

al., 2002; see also: Lau et al., 2012)

[illegible]guistic agency of vax ↑ belief in mandatory vaccination policies (Bell et al., 2014)

MEMES & EVOLUTION—BASIC AXIOMS:

Meme: Recent revivals and reconsiderations of memes and memetic theory:

- Shifman, L. (2013). Memes in a digital world: Reconciling with a conceptual troublemaker. *Journal of Computer-Mediated Communication, 18*, 362-377. [identifies 4 approaches to online memes, and 3 dimensions: content, form, stance, or communication]
- Simmons, J., et al. (2014). The universal principles of evolution. *World Futures, 70*, 426-441. [argues for the literal parallel between genes and memes as analogous processes of information transfer]
- Wiggins, B. E. & Bowers, G. B. (2014). Memes as genre: A structurational analysis of the memescape. *New Media & Society*, published online first [describes meme evolution stages of maintenance, elaboration, and modification]

MEMETYPES (ala McFedries, 2011):

1. **Active meme v. latent meme:** An active meme affects host behavior, v. a meme that has no obvious effect. A host that is negatively affected has a *meme allergy*, and if destructive, it is a *memoid*. When prior infection inoculates against further effect, it is an *immuno-meme*.
2. **Grassroots meme**: Memes generated by 'ordinary users' (v. celebrity or organization). Faked grassroots memes are *astroturf memes*.
3. **Comemes**: Memes that evolve alongside or in concert with, larger memes. If the relationship is cooperative or symbiotic, it is a *symmeme*.
4. **Bait v. Hook Memes**: Bait memes offer an incentive for its adoption, and hook memes cause the adopted meme to replicate (e.g., Christianity [main] carries with it the bait meme of an afterlife, and once adopted, the spreading of the gospel is incentivized [hook meme]).
5. **Memeplex**: A constellation of memes with stable main memes and affiliated comemes.
6. **Memetic hubs**: Forums or groups that are prolific meme generators or amplifiers. Such hubs tend to specialize in phrasal templates or image macros that facilitate mass meme generation.
7. **Meme hack**: Modification of an ad or meme, often with intent to subvert (e.g., Ebola for Coke insignia)
8. **Zombie Lie**: A false meme that continues to replicate.

CONSTRUCTS, RELEVANCE & EXEMPLARS:

1. **Redundancy-repetition**: For example, the degree to which retweeting a movie title appears to positively reinforce further retweeting of that movie title.
2. **Digital divide deficits**: For example, the degree to which poor (low SES) geographic areas are less likely to request personal exemptions to vaccines (because they are more networked into media-biased views of vaccines? Because wealthy are more likely to put their children into charter schools, which reflect a higher priority on individual choice and freedom from government control?)
3. **N past resonant memes**: For example, did "Jasmine Revolution" morph into "Arab Spring"
4. **Narrative or frame fidelity (resonance):** For example, do certain search (ontology) terms "linguistically mark" resonant narratives and themes of militias, hate groups, etc.?
5. **Subjective homophily or cohesiveness:** Do hate, militia, and white supremacy groups (or 911 conspiracists, Obama a Muslim, and vaccination parental exception groups) swap (e.g., anti-government) memes?
6. **N counter-memes:** For example, do such groups create a consistent and resonant set of memes about groups with contrary values as a way of marking their groupness and "us-versus-them" ideologies (and thus, homophily)?
7. **Earlier stages of adoption:** Do movie title memes reveal a prototypical diffusion stage evolution?

CONSTRUCTS, RELEVANCE & EXEMPLARS:

9. **Agenda-setting promotion:** Do tweets about movies reveal responsiveness to studio promotional events?
10. **Rival social or media networks:** i.e., niche availability; for example, are anti-vaccination tweets "muted" or counteracted by government health communication campaigns?
11. **Counter-memes and frames:** Are some memes counteracted by being taken over by new memes—e.g., Do we forget about Libya and Anthony Wiener because of an NSA leak?
12. **Later stages of diffusion adoption:** Given that in later stages of diffusion there is "less information space" (niche) for (innovation) diffusion adoption, does this explain the decline of most memes (e.g., candidacy memes, "Arab Spring," etc.)?
13. **Geospatial span or scope of resonance:** Demonstrating that searches for Mayoral names or candidate names during a regional primary are geospatially differentiated.
14. **Proximity facilitation:** Does the tendency of homophily bring similar kinds of people into geographic areas (e.g., wealthier neighborhoods) and thereby reinforce denser social networks and certain memes (e.g., anti-vaccination)?
15. **Popularity:** e.g., the number of tweets
16. **Velocity:** e.g., how rapidly tweets or web content spreads
17. **Longevity:** e.g., how long a meme (e.g., movie title meme) continues being popular
18. **Fecundity:** e.g., how many derivations of a given meme evolve out of the original meme